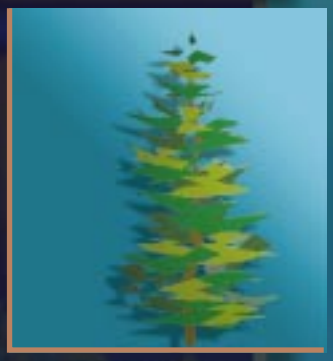
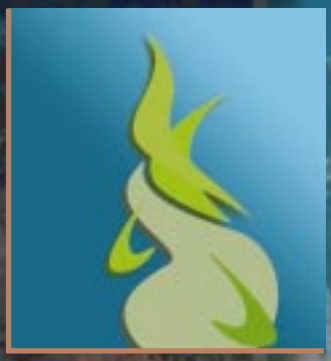
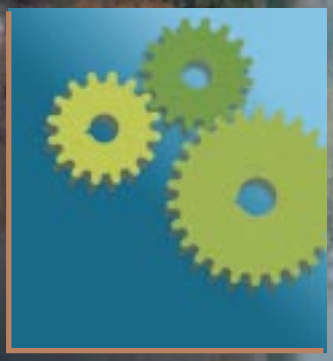
Economic Benefits



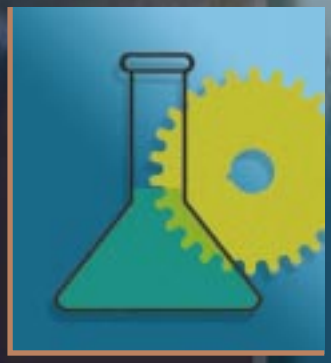
Environmental Quality



Energy Security



Reliability/ Durability

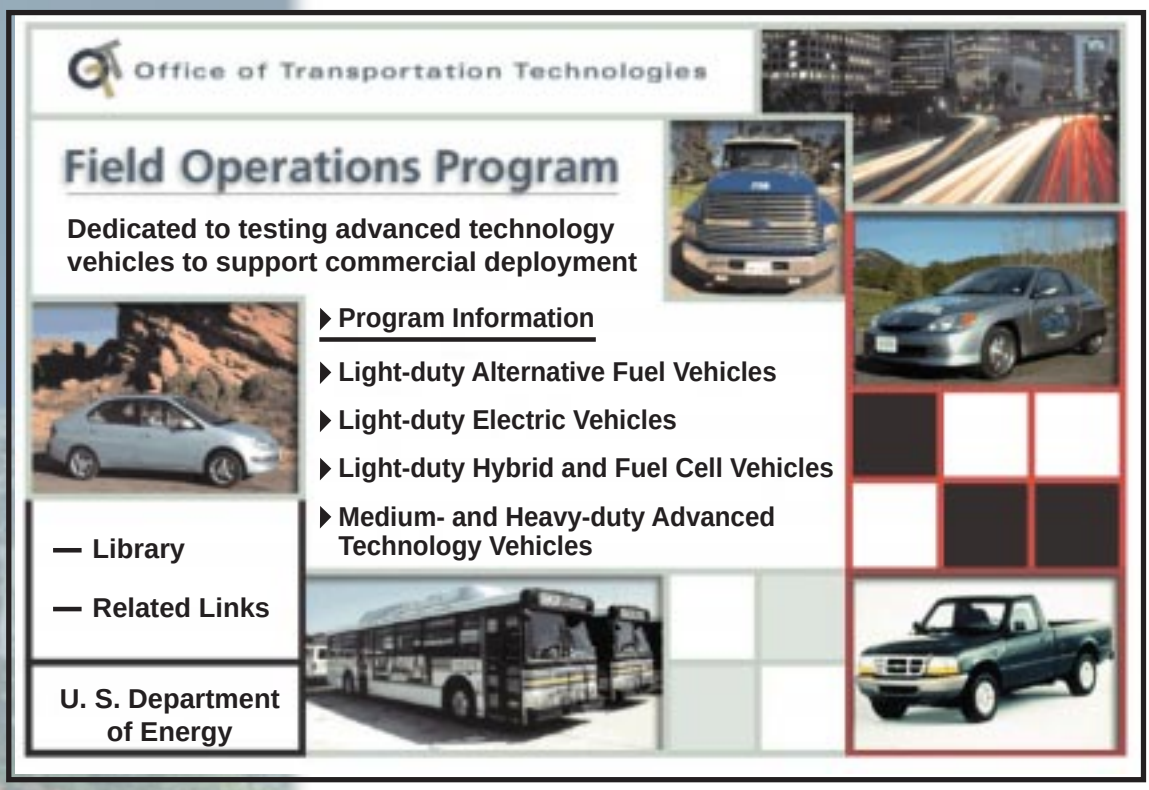


Science and Engineering

DOE's Field Operations Program

Testing Advanced Technology Vehicles in Partnership with Industry

http://www.ott.doe.gov/otu/field_ops/



Visit us @
http://www.ott.doe.gov/otu/field_ops/

Program Overview

The Field Operations Program provides fleet managers and other potential advanced technology vehicle (ATV) users with accurate and unbiased information on vehicle performance. This allows the purchaser to make informed decisions about acquiring and operating ATVs. Vehicle information is obtained by testing ATVs in conjunction with industry partners and disseminating the testing results.

The ATVs are tested using three methods - Baseline Performance Testing, Accelerated Reliability Testing, and Fleet Testing. The testing results are disseminated on the Program's Website in the form of vehicle fact sheets, summary reports, and survey results. Additional information on the Website includes testing procedures as well as general information about ATVs, such as how they work and their histories.

TH!NK City EV

Toyota Prius hybrid

The U.S. Department of Energy's Office of Transportation Technologies (under the Office of Energy Efficiency and Renewable Energy) manages the Field Operations Program, which is conducted jointly by the Idaho National Engineering and Environmental Laboratory in Idaho Falls, Idaho, and the National Renewable Energy Laboratory in Golden, Colorado. The Program works with commercial and government fleets, and industry groups to support the testing and deployment of ATVs in today's evolving transportation market. Test procedures are developed jointly with industry stakeholders to measure real-world performance. The Field Operations Program's testing and information dissemination activities are divided into four areas:

- Light-Duty Alternative Fuel Vehicles
- Light-Duty Electric Vehicles
- Light-Duty Hybrid and Fuel Cell Vehicles
- Medium- and Heavy-Duty Advanced Technology Vehicles

Chevrolet Triax hybrid/EV

What Are Advanced Technology Vehicles?

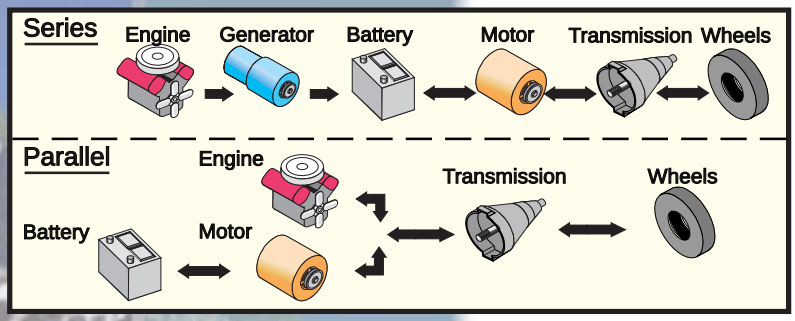
ATVs include light-, medium-, and heavy-duty on-road vehicles with hybrid powertrains, alternative fuels in internal combustion engines, fuel cells in hybrid powertrains, and pure electric vehicles (EVs) with advanced energy storage systems. The Program concentrates on testing and disseminating information for these leading-edge technologies.

What Are Hybrid Electric Vehicles?

Some hybrid electric vehicles (HEVs) combine a conventional internal combustion engine (using gasoline, diesel, natural gas, ethanol, or other fuel) with the battery and electric propulsion motor of an electric vehicle. Other hybrids combine a fuel cell with batteries to power electric propulsion motors.

Hybrids, with internal combustion engines, are designed as either series or parallel hybrids, depending on how the engine is used. In the series mode, the engine drives a generator that charges the batteries and provides electricity to the electric motor, which turns the wheels. In the parallel mode, the internal combustion engine, or the electric motor, or both, turn the wheels. If an HEV has a fuel cell, the electricity generated by the fuel cell can be used to charge the batteries and power the electric motor, which turns the wheels.

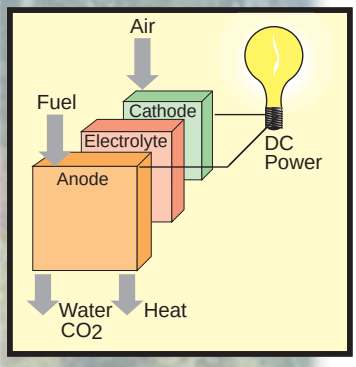
Hybrid vehicles combine the extended range and rapid refueling that consumers expect from a conventional vehicle with some of the energy and environmental benefits of an electric vehicle. The practical benefits of HEVs include improved fuel economy and lower emissions compared to conventional vehicles. The inherent flexibility of HEVs allows them to be used in a wide range of applications, from personal transportation to commercial applications. While HEVs with internal combustion engines are now available in limited numbers, the large-scale deployment of HEVs with fuel cells is still several years away.



Series and parallel hybrid configurations

What Are Fuel Cells?

Fuel cells generate electric power by combining hydrogen and oxygen in an electrochemical device that operates without combustion, so they are pollution free and the only by-products are water and heat.



How fuel cells work

Since hydrogen fuel is converted directly to electricity, a fuel cell can operate at much higher efficiencies than internal combustion engines, extracting more electricity from the same amount of fuel. The fuel cell itself has no moving parts, making it a quiet and reliable source of power. Fuel cells produce DC voltage that can be used to power motors and lights, and charge batteries. Originally developed in the 1800s, fuel cells have been used in the U.S. space program since the 1950s and have the potential to replace internal combustion engines in many applications.

Light-Duty Alternative Fuel Vehicles

Ford CNG E350 van

The Light-Duty Alternative Fuel Vehicle (AFV) Evaluation Program assists the U.S. Department of Energy in meeting the requirements of the Alternative Motor Fuels Act (AMFA) of 1988. The AMFA requires the placement of alternative fuel passenger vehicles and light-duty trucks into federal fleets, and studies of their performance, fuel economy, safety, and emissions. AMFA also requires the collection of similar information for transit buses and heavy-duty trucks in commercial fleets.

Light-Duty AFV Fleet Evaluations

These test and evaluation projects collect and provide objective information on real-world fleet experiences with AFVs.
Fleet Studies: These studies demonstrate if AFVs can meet fleet

mission requirements. The studies assess whether the operational performance and costs of AFVs are similar to, better than, or not as good as similar gasoline vehicles. Fleets tested include:

Honda CNG Civic and Dodge CNG van undergoing testing

- SuperShuttle Denver Fleet: compressed natural gas (CNG) vans
- Barwood Cab Fleet: CNG sedans
- State of Ohio Fleet: ethanol/gasoline blend (E85) sedans
- State of Texas Fleet: propane (LPG) pickup trucks

Ford CNG Crown Victoria

AFV Fleet Manager and Driver Surveys: Several surveys have collected real-world experience on the performance and operation of AFVs in federal, state, and city government fleets. Fleet manager and driver perspectives have also been obtained.

Light-Duty AFV Performance Evaluations

New Vehicle Evaluation: This project conducted vehicle performance tests of AFVs newly released into the market and their conventional gasoline counterparts. Seven vehicle pairs were tested for acceleration, braking, fuel economy, emissions, cold start, and driveability and handling. The project used the test data to generate fact sheets for dissemination to fleet managers and general consumers to support their AFV purchasing decisions.

Honda CNG Civic

AFV Emissions Tests: In-use emission testing results for light-duty AFVs fueled by CNG, E85, methanol/gasoline blend (M85), and LPG can be found on the Website. These extensive tests were conducted according to the Federal Test Procedure for light-duty chassis dynamometer testing. Results include data on primary exhaust-regulated emissions (carbon monoxide, oxides of nitrogen, and hydrocarbons), as well as aldehydes, alcohols, carbon dioxide, and evaporative emissions. In addition, hydrocarbon speciation was performed on the hydrocarbon emissions from a subset of the test vehicles to evaluate their toxicity and ozone-forming potential.

Light-Duty Electric Vehicles

Dodge Intrepid ESX2 hybrid

The Field Operations Program, in conjunction with its Qualified Vehicle Testing (QVT) partners, uses several testing methods to validate vehicle performance. The Program's QVT partners include:

- Electric Transportation Applications (lead partner)
- Arizona Public Service
- Southern California Edison

Jeep Commander 2 hybrid

- Potomac Electric Power Company
- Salt River Project
- Virginia Power
- Bank One of Arizona
- Southwest Airlines
- American Red Cross.

EV Baseline Performance Testing

Also referred to as EVAmerica testing, the Baseline Performance testing is conducted on closed tracks and dynamometers, and the results are highly repeatable. The test parameters include acceleration, three types of range tests, gradeability, handling, charging, maximum speed, braking, and minimum safety standards that the vehicles must meet. Since 1994, over 20 models of electric vehicles have been EVAmerica tested.

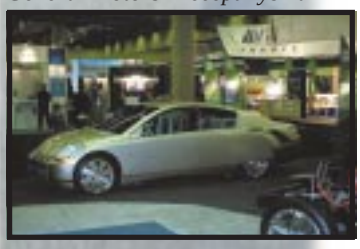
General Motors EV1

The Field Operations Program also supports Urban and Highway Pomona Loop testing, which is performed on Southern California streets and highways. In addition to confirming EVAmerica test results, the Pomona Loop testing sometimes provides access to vehicles that are only available in California. The testing includes eight range tests at combinations of minimum and maximum payloads, with full or no auxiliary loads. Since 1997, over a dozen models of electric vehicles have been Pomona Loop tested.

EV Accelerated Reliability Testing

The accelerated reliability testing is similar to the Fleet Operations testing with the important difference that the vehicles are operated in an accelerated mileage mode. That is, the QVTs operate each vehicle up to 25,000 miles per year (30,000 miles for vehicles equipped with advanced batteries). The goal is to obtain several years of traditional fleet-use operations data within a single year. The information disseminated includes energy use, maintenance requirements, and the effects of accumulated mileage on vehicle range. Energy use is collected with kilowatt-hour (kWh) meters mounted onboard the vehicles conductively charged or mounted on dedicated chargers for vehicles that are inductively charged. Several other parameters are calculated, including miles per kWh and charging profiles, not only for entire fleets, but also for single model types and individual vehicles.

General Motors Precept hybrid



EV Fleet Testing

In this testing process, the QVTs collect data on electric vehicles within their respective commercial fleets. The data collected includes energy use, mileage, and maintenance requirements. Energy use is collected and disseminated the same way as during accelerated reliability testing.

Urban and Neighborhood Electric Vehicle Testing

The Field Operations Program is developing test procedures for new classes of pure electric vehicles designed for the emerging urban and neighborhood markets. Testing these classes of vehicles requires the modification of the existing EVAmerica test procedures in areas such as coast-down testing and drive-cycle testing. These vehicles also require the development of new performance goals, as the use for these vehicles will be different than originally envisioned for full-size electric vehicles.

Toyota E.com EV

Light-Duty Hybrid and Fuel Cell Vehicles

Hybrid and fuel cell vehicles require completely new test procedures given the variety of operating scenarios. For instance, should HEVs be tested in pure electric modes, combined modes, or only in drive cycles when internal combustion engines or fuel cells provide energy and power? The Program is developing HEV test procedures that incorporate these and other operating scenarios while it performs initial testing on HEVs such as the Honda Insight and Toyota Prius. These initial tests will be used to refine testing procedures to incorporate the lessons learned.

TH!NK Neighbor EV

The existing Accelerated Reliability test procedures will also be modified to accommodate these new-technology hybrid and fuel cell vehicles. When the test procedures have been developed, they and all the test results will be posted on the Website.

Honda Insight hybrid

Medium- and Heavy-Duty Advanced Technology Vehicles

Orion IV hybrid

This activity supports the Program's efforts to move advanced vehicle technologies from the research and development stage to the medium- and heavy-duty vehicle marketplace. Advanced technologies, such as hybrid electric and fuel cell vehicles, are just beginning to show up in the medium- and heavy-duty vehicle market. Because the technologies are not yet widespread, our first projects involve "early adopters" of advanced vehicle models.

The Field Operations Program is participating in the evaluation of 10 Orion hybrid electric buses now in operation in the New York City Transit (NYCT) fleet. Sponsored by DOE's Office of Heavy Vehicle Technologies (OHVT), the project involves collecting fueling, maintenance, performance, and emissions data from the fleet for 12 months.

ISE Research Thundervolt hybrid

The Field Operations Program will enhance OHVT's bus evaluation by defining NYCT's vehicle performance expectations, identifying and collecting vehicle performance information, and assessing how well the

buses meet NYCT's objectives. In an effort to help other fleet managers who are considering making similar choices, the Program also will document NYCT's experience. Future testing activities will include:

- Documentation of fleet experiences with CNG transit buses.
- Assistance in the development of design guidelines for bus transit systems using electric and/or hybrid electric power.
- Collaboration with the California Fuel Cell Partnership in the evaluation of fuel cell transit buses at SunLine and AC Transit Agencies.
- Participation in the Hybrid Electric Bus Working Group and the American Public Transportation Association's Electric Bus Subcommittee, Alternative Fuels Committee, and Clean Fuels Technology Coordinating Committee.
- Evaluation of medium- and heavy-duty advanced technology delivery trucks in fleet applications.

For More Information

http://www.ott.doe.gov/otu/field_ops/

Jim Francfort
INEEL
P.O. Box 1625
Idaho Falls, ID 83415-3830
(208) 526-6787
Fax (208) 526-0969
francfje@inel.gov

Richard Parish
NREL
1617 Cole Boulevard
Golden, CO 80401-3393
(303) 275-4453
Fax (303) 275-4415
richard_parish@nrel.gov

Published March 2001
INEEL/EXT-01-00168

PRINTED WITH SOY INK

Recycled/recyclable